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INTRODUCTION

Over the past few years the electricity supply industry has been central to the energy efficiency debate in the UK. Not only is electricity widely used in homes, offices and factories, but the industry is itself a major energy consumer. This paper has been produced by the Office of Electricity Regulation (OFFER) as a contribution to a growing debate about energy efficiency, following the privatisation of the electricity industry.

The paper summarises the powers and responsibilities of the Director General of Electricity Supply (the Director General) in connection with energy efficiency. It reviews the current position in Great Britain on the efficient use of electricity in relation to the generation, transmission, distribution and supply of electricity. The paper then outlines the impact that the structure and regulation of the industry may have on the way in which electricity is used. Against this background the paper also highlights:

- the extent of the existing incentives for companies in the industry to undertake measures with energy efficiency benefits; and,
- a range of options for possible further development of the regulatory framework to reinforce existing incentives, particularly for the monopoly elements of the industry.

Finally, the paper invites comments from the industry, its customers and all others concerned with these issues.

OFFER's Role and Responsibilities

The Electricity Act 1989 established the post of Director General and the Office of Electricity Regulation (OFFER) which he heads. The Director General is responsible for overseeing the industry and has wide ranging powers to ensure that licensees comply with conditions set out in their licences. The Director General must exercise his statutory functions in a manner which he believes is best calculated to achieve certain general duties. These general duties are set out in section 3 of the Act; the three primary duties are:

- to secure that all reasonable demands for electricity are satisfied;
- to secure that licence holders are able to finance the carrying on of the activities that they are authorised by their licence to carry on;
- to promote competition in the generation and supply of electricity.

Subject to these duties the Director General must also exercise his functions in a manner which he considers is best calculated -

- to protect the interests of consumers.... in respect of
  (i) the prices charged and other terms of supply;
  (ii) the continuity of supply; and
  (iii) the quality of electricity supply services provided, and
- to promote efficiency and economy on the part of persons authorised by licences to supply or transmit electricity and the efficient use of electricity supplied to consumers.

The Director General's other duties include promoting research into, and the development and use of, new techniques to generate, transmit or supply electricity. He also has a duty to take into account, when exercising his functions, the effect on the physical environment of activities connected with the generation, transmission and supply of electricity.

These general duties are supported by specific powers, two of which are of direct relevance to the efficient use of electricity. All 14 companies with public electricity supply licences (that is the Regional Electricity Companies, Scottish Power and Scottish Hydro-Electric) are required to produce, after consultation with the relevant Electricity Consumers' Committee, Codes of Practice on the efficient use of electricity. These require the approval of the Director General.

Secondly, the Director General may, after consultation, "determine such standards of performance in connection with the promotion of the efficient use of electricity by consumers as in his opinion ought to be achieved" by public electricity suppliers (PESs). Those companies must provide the Director General with information about their performance against any such standards of performance. The Director General must publish that information at least once a year. These powers and obligations are set out in sections 41 and 42 of the Act. To date, the Director General has not set such standards. A decision on whether specific standards would be helpful will be taken after assessing what the companies have achieved in line with the Code of Practice and any voluntary initiatives.

Many of the Director General's other functions may also affect the efficient use of electricity. Indeed, when exercising any of his functions (except those relating to the determination of disputes) the Director General must take into account his duty in relation to the efficient use of electricity, along with all of his other duties set out in section 3 of the Act. One particular area which is likely to be of relevance to the efficient use of electricity is the revision to the price control formulae set out in the supply and transmission licences.

The promotion of the efficient use of electricity supplied to consumers cannot stand as an objective in isolation, either from the Director General's other duties or from other issues in the electricity industry relating to the efficient use of energy (for example, the use of primary fuel in power stations). This paper discusses the efficient use of energy by the electricity industry as well as the promotion of the efficient use of electricity by consumers. Both have an important role to play in the wider energy efficiency debate.

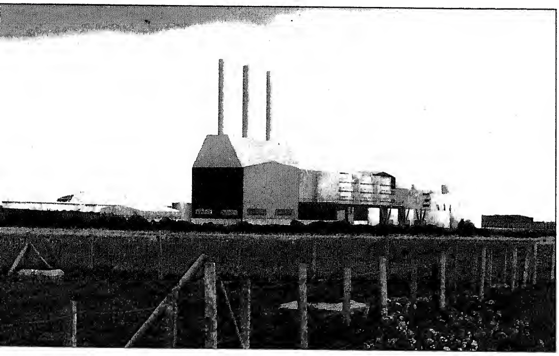
THE PRESENT POSITION

Generation

Most electricity in Great Britain is produced at power stations where the primary fuel (eg nuclear, coal, oil, gas) is used to produce steam at high pressure, which provides the rotary motion required by the alternator to produce electricity. The technical efficiency of power stations has increased dramatically. In 1947 the thermal efficiency of conventional steam power stations was around 20 per cent. For the next 40 years the generating industry produced larger and larger coal and oil fired power stations with improving thermal efficiencies. By 1990 the newest power stations achieved an efficiency of over 35 per cent.

Since then, generators have chosen to build smaller power stations: primarily Combined Cycle Gas Turbines (CCGTs). These stations are cheaper to build and, by using the high temperature reject heat from the gas-turbine exhausts in a waste heat boiler, are inherently more efficient than traditional fossil fuelled stations. Thermal efficiencies in excess of 50 per cent are expected. There is a direct incentive on generators in the competitive market to reduce generating costs by improving efficiency in this way.

Photo-montage of planned Combined Cycle Gas Turbine power station at Killingholme



Combined Heat and Power

Much interest is also being shown in Combined Heat and Power (CHP). These schemes generate electricity but, rather than wasting the residual heat, use it as a useful energy resource in its own right. CHP schemes are suitable for applications where a guaranteed heat load exists. If suitable recipients for their electrical and heat outputs can be found they can achieve exceptionally high thermal efficiencies of up to 80 per cent. Sizes range from a few tens of kilowatts to many megawatts and applications include industrial sites, hospitals and leisure centres. Such plant is often linked to the distribution system owned by the PES. This allows the CHP unit to be designed to match the heat load requirements, with the balance of electrical load (or output) being imported from (or exported to) the local distribution system.

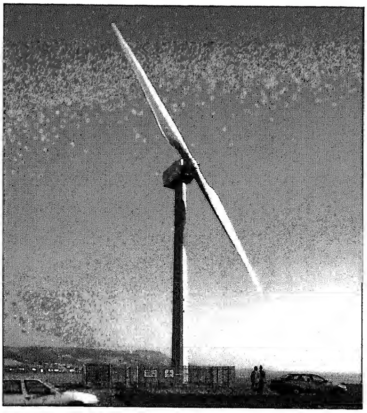
In some parts of Europe and North America, CHP schemes are associated with District Heating schemes, where the heat produced at the CHP plant is used to make steam or hot water which is distributed for use by homes and businesses in the immediate locality. Several District Heating schemes have been proposed in the UK and one is currently being installed in Sheffield.

Under the Electricity Act, CHP and District Heating operators can apply for powers to lay heat mains and electricity cables, which lifts barriers to the installation of CHP schemes. Small scale CHP units have already proved successful. These may be accompanied by Contract Energy Management Schemes, under which suppliers of CHP equipment agree to operate and maintain the scheme, and provide heat and electricity to the final customer at agreed prices. Several Regional Electricity Companies (RECs) have expressed interest in CHP schemes in their areas. OFFER is establishing a database recording details of all schemes in Great Britain. This will be the first time that such information has been collected on a consistent basis.

Renewable Energy

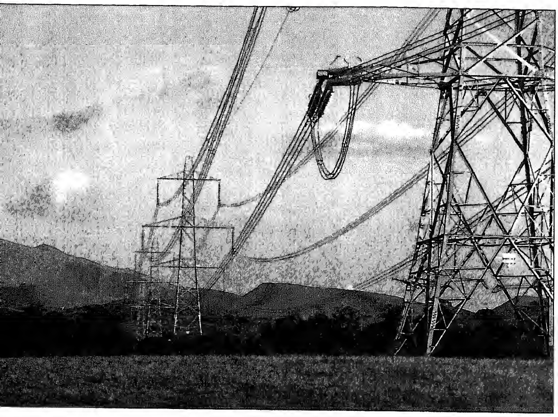
Most existing generating capacity relies on finite primary fuel resources. Renewable energy sources such as wind, hydro-electric, tidal, and solar power as well as gas from waste are not limited in this sense. These sources do not deplete finite reserves, though they can have other environmental impacts. Under the Electricity Act the Secretary of State has required PESs in England and Wales to contract for a specified minimum amount of non-fossil fuelled electricity, both nuclear and renewable. These generating technologies are at present normally more expensive than fossil fuelled generation. A premium is therefore paid to those generators, the cost of which is met by consumers under the fossil fuel levy.

The Director General advises the Secretary of State on the level of the obligation to purchase from renewable energy sources. About 550MW of capacity of renewable energy supported by the levy is built or planned in England and Wales; this compares with a total generating capacity of over 55,000MW. The Government has stated that it will work towards a figure of 1000 MW of renewable electricity generating capacity by the year 2000. The longer term technically achievable contribution of renewable energy has been estimated as equivalent to nearly a quarter of current electricity supply by 2025. Increasing the use of renewable energy at the expense of fossil fuels helps reduce emissions of environmentally harmful gases such as carbon dioxide, sulphur dioxide and oxides of nitrogen.



Transmission and Distribution

The transmission and distribution systems link the power station to the consumer. These systems expend electrical energy in the form of losses. The location of power stations can have a



significant impact on the extent of losses on the transmission systems. At present most generation is located away from centres of demand, reflecting the economics of siting coal and oil-fired stations at the most convenient points to obtain fuel and cooling water supplies. As a result, there is a significant flow of electricity from the north (where most generating capacity is based) to the south. The National Grid Company (NGC) is currently reviewing the structure of the charges for the use of the transmission system. It will be important to ensure that the right price signals are given on the location of new generating plant.

Some losses are fixed in nature and occur regardless of the loading on the network. Others are variable and increase with factors such as system loading. There is scope by means of capital investment to reduce some of these losses. Various techniques have proved attractive. These include the use of higher capital cost transformers which have lower losses, and the use of power factor correction equipment, particularly on distribution networks and at consumers' installations to reduce system losses and improve system capacity. Since privatisation, the incentives for transmission and distribution companies to take such measures have changed, in part because of the price control formulae which now apply. This is a factor which will need to be taken into account in the review of the price control formulae. Any disincentive should be removed where practicable.

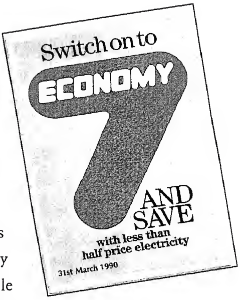
Both the transmission and distribution networks are planned to security standards set out in the respective licences. These security standards require that the size of the network is such as to ensure continuity of operation under unusual or emergency conditions. As a result, some increases in peak demand can be safely carried by the existing network. As peak demand rises, additional investment in the networks is normally required to reinforce the system if security levels are to be maintained.

Load Management

Electricity demand varies according to the time of day, the day of the week and the season. Normally demand is at its highest during cold weather and week-day early evenings, and at its lowest during warmer weather, the night and at weekends. The cost of production also varies broadly in line with demand, so the higher the overall level of demand, the higher the average cost of production. As the system was planned to meet present and foreseen future levels of demand, there is an excess of generating capacity over demand, with some plant used only briefly during peak demand periods.

Overall costs can be reduced and in particular the need for new capacity limited, by changing load patterns to smooth out peaks and spread demand more evenly across the day (and across the year). Prior to privatisation there had already been some encouragement to load switching. Tariffs for both industrial and domestic customers gave lower prices for off-peak demand. The Economy 7 tariff attracted large numbers of domestic customers by offering price savings for night-time electricity associated with storing heat and hot water. Industrial maximum demand tariffs encouraged load shifting by having significantly higher prices for demand at peak periods.

Since privatisation there has been greater emphasis on cost reflective prices for all groups of customers. For the largest customers load management contracts give lower rates to customers who are prepared to cut demand when required. For domestic customers new three rate tariffs have been introduced by a number of companies. The companies have an incentive to encourage these developments as they promote additional sales at times when spare capacity is available and electricity is least costly. They also reduce the financial risks associated with simpler price structures. To the extent that customers respond to the price signals, this will also restrain the growth of peak demand, hence delaying the need for additional capacity on the distribution and transmission systems. Where the customer or the supplier has control over the time at which supply is taken, significant savings can be achieved by shedding load, to avoid short term price and demand peaks. The take-up of load management contracts and multi-rate tariffs suggests that some customers are prepared to adjust demand given the right price incentives.

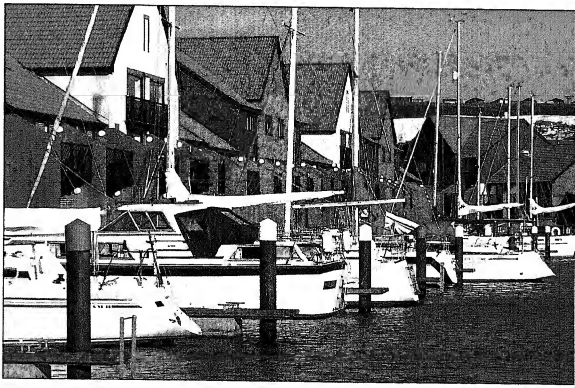


Load management and load switching do not necessarily reduce overall electricity demand. Indeed, as far as the individual customer is concerned, some load switching may result in greater energy use (for example because of the losses involved in storing heat) but typically at a lower total cost.

Competition with Other Fuels

Where competition with other fuels (primarily gas) has been a significant factor, more emphasis has been placed by the companies on the benefits of energy efficiency measures. Indeed, most companies have stressed that they see greater efficiency as going hand-in-hand with their marketing of the benefits of electricity. Schemes

Medallion 2000 development at Port Solent, Hampshire

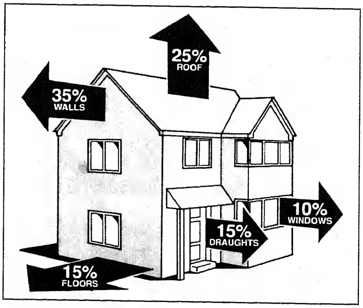


like Medallion Award Homes have set insulation standards for new all-electric houses. In industry, the companies have sponsored awards such as PEP (the Power for Efficiency and Productivity Award) and BETA (Building Efficiency Award) which highlight the savings that can be achieved by using electricity.

Competition between fuels will continue to give an incentive to the companies to encourage energy efficiency on the part of customers. This is most evident where inter-fuel competition is at its fiercest - particularly with space and water heating. There are however many areas where competition between fuels does not exist or is limited. For example, in the domestic market about half of total electricity consumption is estimated to go on applications for which there is no effective substitute for electricity (such as lighting).

The Scope for Improvements in the Efficient Use of Electricity

Electricity is used throughout industry, commerce, agriculture and homes to provide heat, motive power and lighting. It is used in scores of applications as diverse as electric toasters, computers and grain dryers. As with all energy sources (indeed all resources), electricity could be used more efficiently. Analysis by the Energy Technology Support Unit (ETSU) suggests that energy efficiency measures could produce a 20 per cent reduction in industry's energy bill by the year 2000. ETSU and the Building Research Energy Conservation Support Unit (BRECSU) both consider similar proportional savings are possible in the domestic, commercial and public sectors.



Heat loss from a typical home

There continues to be scope for cost-effective efficiency improvement measures in almost all applications of electricity. That is, the customer can make a positive return on investments in insulation or new equipment, taking the savings either through reduced electricity use or through an increase in warmth or other benefits. Of course, account must be also be taken of any disadvantages associated with such measures.

In some circumstances the required investment is minimal and the return substantial (for example draught-proofing). It is clear however, that there continues to be a slow take-up of many efficiency measures. More efficient light bulbs, such as compact fluorescent lighting, use much less electricity and can last ten times longer compared with tungsten filament light bulbs. A recent estimate suggests however that on present trends it could be over 200 years before low energy lighting has penetrated 90 per cent of the domestic market. The take-up of products such as efficient lighting is of course influenced by factors other than their energy efficiency. For example,

Norman Cabinets Ltd, winner of Midlands Electricity plc PEP award 1990

the initial outlay is much higher, their appearance is significantly different from traditional light bulbs and many consider the quality of light is also different. For the consumer, these other factors may be more important than the energy saving potential of the product.

Potential Barriers to Energy Efficiency Measures

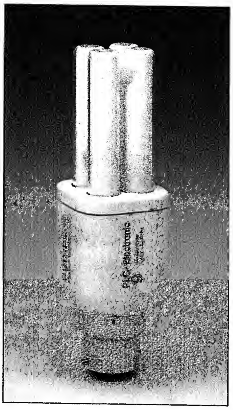
Energy efficiency does not mean simply using less energy. It would be inappropriate to adopt, as an aim in its own right, the objective of preventing or discouraging the production or use of energy, regardless of other issues. Companies will properly seek to use energy where the value of the goods and services thereby produced exceeds the cost of production. Likewise, people will tend to adopt energy-saving measures where the benefits they perceive outweigh the costs or disadvantages. But if the price mechanism is distorted, or if the costs and benefits associated with particular options are not known, this may not occur.

Commentators often present these latter considerations in the form of three potential barriers to the adoption of appropriate energy efficiency measures.

- market distortions: energy prices often do not fully and accurately reflect all costs, for example where environmental costs are excluded;
- investment priorities: many customers tend to give energy efficiency measures a low priority compared to other investment options, particularly small businesses and low income households where access to investment funds may be very limited; and
- lack of information: there may be insufficient information available to customers about the benefits of efficiency measures and the range of options available.

Some of these issues lie outside OFFER's remit. How to deal with environmental costs is a matter for Government, the European Commission and international bodies. Such matters cannot be dealt with effectively or adequately by individual utilities or their regulators. Equally, issues such as the type and extent of assistance for low income households are also primarily matters for Parliament to consider. As discussed in the next chapter, however, there are other issues relating to market distortions, investment priorities and the provision of information which are particular to electricity, and where the regulatory regime has a role to play.

Philips Lighting



THE IMPACT OF THE NEW ELECTRICITY INDUSTRY

The restructuring of the electricity industry, and the introduction and promotion of competition in generation and supply, may be expected to reduce all three of the barriers to energy efficiency just identified in the previous chapter.

Competition in Electricity Generation and Supply

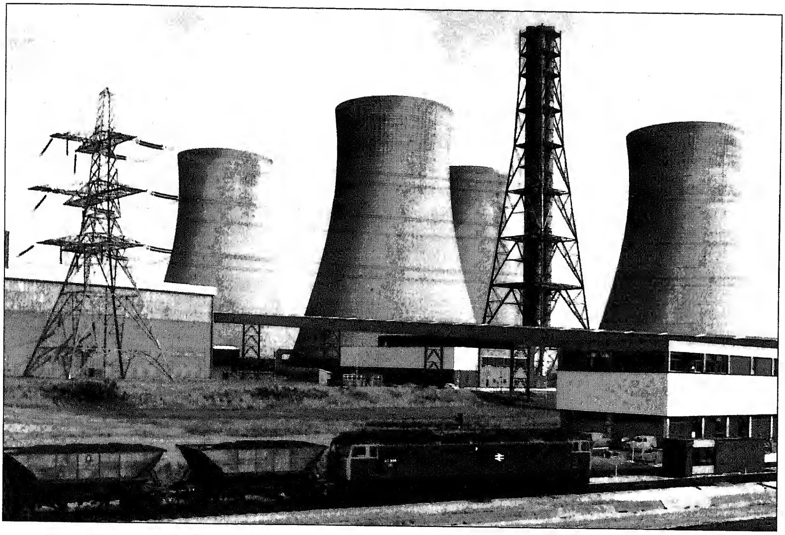
Competition in generation gives an incentive to generators to reduce the costs of generation. Fuel is by far the largest single factor in a generator's costs. Efficiency improvements thus provide considerable scope for savings, the advantages of which will be shared with customers through the operation of a competitive electricity market. Promoting further competition in generation is therefore a particularly important means of increasing energy efficiency.

Competition in supply means that any company with a second-tier supply licence can supply customers, using the PESs' distribution networks. Such suppliers presently include the major generating companies, a few large industrial customers, the two supply companies in Scotland and RECs supplying customers outside their authorised areas.

From 1 April 1998 all customers will have the right to choose their supplier. However, until then the PESs have the sole right to supply franchise customers in their own authorised area. Franchise customers are those with a maximum demand of 1MW or less (until 31 March 1994) and 100kW or less (from 1 April 1994 until 31 March 1998).

Competition in supply limits a company's ability to underprice peak electricity at the expense of off-peak electricity or other services. Competition in supply also provides the opportunity and incentive for rival suppliers to assist customers by devising schemes to overcome limited investment funds, and to inform them of valuable opportunities for increased energy efficiency of which they might otherwise be unaware.

In competing for supply contracts in the competitive market, a number of suppliers have already emphasised to potential customers the contribution that their company can make to the customer's efficient use of electricity. It seems likely that such developments will increase in future. This may take the form of broader energy management assistance for industrial and commercial supply contract customers. That is, in addition to selling electricity, the supplier would also advise the customer on how to minimise costs by using electricity more efficiently and by switching load to avoid peak demand charges. Companies which can provide such services for customers will have an important competitive advantage in their supply business. Energy management companies, which contract to provide customers' energy needs at lowest cost, and are able to take advantage of competition in electricity supply, can be expected to have an increasing role.



The development of a competitive market in electricity supply also goes hand in hand with the introduction of new metering and communications technologies. These will facilitate more sophisticated and cost reflective pricing structures as well as load management arrangements of the sort described above. Such measures are conducive to energy efficiency. They could, of course, be adopted by PESs even where competition is not yet allowed or effective.

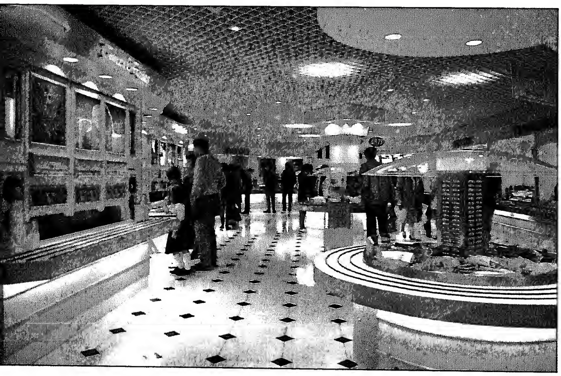
It is too early to assess the full effect that the competitive regime in electricity supply will have on the efficient use of electricity. As noted above, however, competition with gas and other fuels has provided an important stimulus for energy efficiency in many applications of electricity. Competition between electricity suppliers should reinforce that stimulus and spread it to those applications where there is little or no effective competition between the fuels.

Consequently, a central task of the regulatory regime is to promote the development of greater competitiveness wherever this can sensibly be achieved. This is not to suggest that competition will solve all the problems and distortions relating to energy efficiency. There are clearly areas where competition is not fully effective and other measures need to be taken. The remainder of this paper discusses these points in more detail.

LIBRARY

Franchise Limits

Competition in electricity supply is at present constrained by the franchise. The franchise limits, which are set out in the second-tier supply licences, are defined in terms of the maximum demand at a single premises. By 1994 an estimated 40,000 to 50,000 customers will leave the franchise market and be free to choose their supplier. Many more customers will be just under the limit of 100kW which will then apply.



Debenhams plc, winner of Midlands Electricity plc Beta award 1990

Some concerns have been expressed that customers just below the franchise limit may have an artificial incentive to boost their maximum demand in order to be able to escape from the franchise market. A comparison is often drawn with the gas industry, where there has been a reported incentive to waste gas in order to achieve usage over 25,000 therms a year which brings contract terms more advantageous than tariff terms.

To date, this has not proved an issue in the electricity industry, although opportunities and incentives may increase as the franchise limit moves down. The licence requires normal operating conditions to be met so there is some safeguard against increasing electricity use simply to evade the franchise.

Nevertheless, even if there is little difference in price at the margin, many customers will prefer the freedom of the non-franchise market in order to take advantage of the wider range of contractual arrangements likely to be on offer. Indeed, from the point of view of energy efficiency, a major disadvantage of the franchise is the reduced scope for competition in the provision of advice and assistance in the use of electricity and the adoption of energy saving measures. This is a consideration which the Director General will need to take into account in any decisions on the franchise limits.

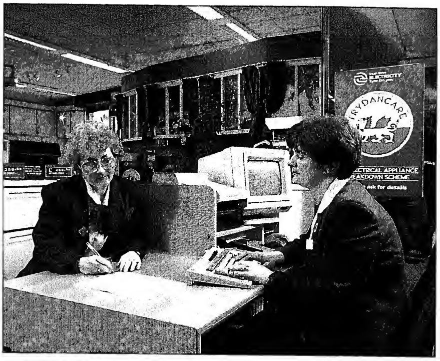
Codes of Practice on the Efficient Use of Electricity

The Codes of Practice on the Efficient Use of Electricity must be produced by the PESs after consultation with the relevant Electricity Consumers' Committee and must be submitted to the Director General for his approval. Codes have now been approved for all 14 companies. These Codes have an important role to play in helping to overcome information barriers to the more efficient use of electricity by consumers, particularly those in the franchise market.

Each PES is expected to provide all its customers on request with practical and impartial advice. This must be designed to help them make informed judgements on measures to improve the efficiency with which they use electricity. Each Code is accompanied by statements which set out information and advice for the different groups of customers. Each company is required under the Code to provide a public telephone information line. Companies must also maintain other sources of more specialist advice, including information on other organisations which can advise customers or offer financial assistance. The approved Code and associated statements must be made available by the company free of charge.

In approving the Codes, the Director General told the PESs that he would be keeping the subject of energy efficiency under review.

USING ELECTRICITY EFFICIENTLY
Code of PRACTICE on the efficient use of electricity
MEB
SWEB
SOUTH WESTERN ELECTRICITY plc
SEEBOARD
CODE OF PRACTICE ON THE EFFICIENT USE OF ELECTRICITY
Yorkshire Electricity
of practice
ent use of electricity
NORTHERN ELECTRIC
Manweb



"I will also be monitoring the effect of this Code carefully. In the light of that monitoring I will be considering whether or not to set standards of performance in relation to [the PESs'] promotion of the efficient use of electricity".

The Director General, together with the Electricity Consumers' Committees, is now considering how best to monitor the companies' compliance with the Codes. It will be important to confirm that the advice being given to customers is accurate and impartial and that it is achieving real results. One way in which performance might be monitored is to conduct an independent survey of the quality of advice given on the telephone advice lines.

Monitoring the volume and source of the requests for information will also be important. One issue that will need careful consideration is how best to identify the success of the advice given in terms of increased consumer awareness and the take-up of energy efficiency measures.

Price Controls

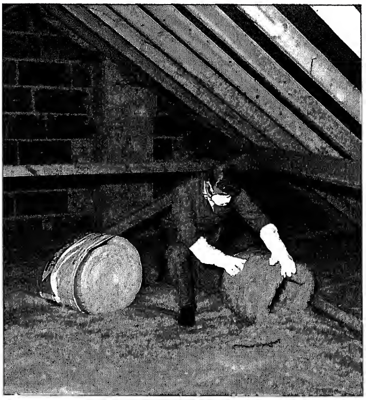
The distribution and transmission elements of the industry are likely to remain monopolies and the PESs have monopoly power in the franchise market. In these areas customers are protected by price controls. The price control formulae, which are set out in the PES and transmission licences, were set by the Secretary of State when the industry was privatised. They are enforced by the Director General who is also responsible for reviewing and revising them in due course.

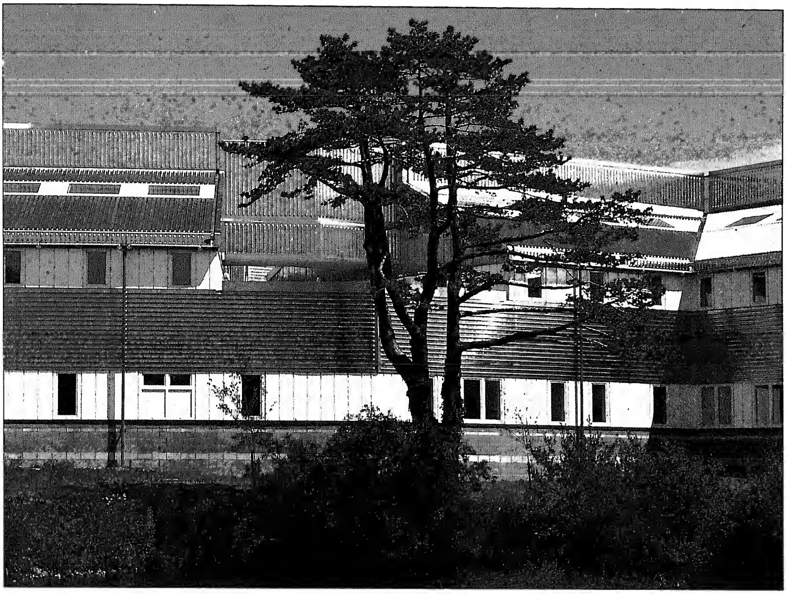
The price control formulae all relate the maximum permissable average increase in the level of charges per unit to the retail price index (RPI), plus or minus an efficiency (or "X") factor. This form of control (commonly known as RPI-X) applies separately to the transmission and distribution businesses. The PES supply price formula also places an RPI-X constraint on part of the supply business revenue. However, the costs to the PES of electricity purchases from generators are not subject to any RPI-X constraints; these latter costs are passed through to final customers. This results in what is commonly known as the RPI-X+Y formula (where "Y" represent the pass-through elements).

Some commentators have suggested that the form of the price controls represents a disincentive on the PESs and NGC to promote the efficient use of electricity. One issue raised is the appropriateness of the price controls on supply allowing for the pass-through of the costs of electricity purchases, but not the costs of saving demand by efficiency measures. This, it is argued, means that the industry has no incentive to consider "demand side" solutions to capacity requirements. A number of commentators have suggested that the existing framework should be adjusted to encourage a least cost planning approach. Another issue is the possibility that the price controls on distribution and transmission provide an undue incentive to increase the sales of electricity. These two issues are considered in turn.

Least Cost Planning

Least Cost Planning is a generic term used to describe a regulatory approach adopted primarily in certain parts of the United States of America. Under Least Cost Planning an electricity company is required to show that it has compared on an equal basis the costs of additional capacity against those of electricity saving measures. Where the "costs of electricity saved" are lower, the company must undertake the energy saving programme and is not permitted to acquire the additional capacity.





A low energy hospital: St Mary's at Newport, Isle of Wight, designed by architects Ahrends Burton and Koralek. Photograph: Terance Grimwood

Typically, the energy saving programme might involve installing efficient lighting in customers' homes and businesses and carrying out insulation work on their properties. Normally these services are provided to the customers concerned at a subsidised rate or even free. Alternatively, incentives are given to customers to carry out efficiency improvement measures (perhaps in the form of loans at subsidised rates of interest). The cost of the programme to the company is recouped as part of electricity charges. This means that all customers pay but not all enjoy the direct benefits of those services. It is argued, however, that charges are lower than would have been the case if the energy saving programme had not been adopted. There continues to be some debate as to how far the reduced demand is measurable, permanent and reliable.

It should be appreciated that the conditions in the USA electric power industry which have led some States to adopt least cost planning are significantly different from the conditions in the electricity industry here. In the USA, electricity is typically provided by vertically integrated utilities whose prices are regulated to cover operating costs plus a return on approved investment. It is widely suggested that, in the past, utilities had an incentive to over-expand generating capacity, for example, by under-pricing electricity, especially at the peak, or by maintaining excessive reserve margins. There is no competition in supply to constrain the passing on of these costs in other ways. More recently, circumstances have changed. Some Regulatory Commissions have allegedly been less generous in approving price increases making expansion less profitable; investors or customers in some utilities have suffered from unexpectedly high costs of nuclear electricity; and there have been environmental and other objections to building new power stations. A number of utilities have found demand-side management projects an appealing alternative to new generation projects where provisions for covering these costs have been incorporated into the price setting procedure.

In Britain, by contrast, the industry is not primarily characterised by vertical integration. RECs do not have a direct profit incentive to increase their total use of generating capacity. Since they are also increasingly subject to competition in supply, their scope for passing on the costs of underpricing electricity is also substantially reduced. So the potential for market distortions, discouraging energy efficiency, seems less than it was in the USA.

At the same time, the scope for regulatory promotion of least cost planning seems to be less in Britain than in the USA. The price controls and other regulations on the suppliers and transmission operators do not impact directly on decisions of generators to build new capacity. Furthermore, because there is competition in supply, any requirement to subsidise demand-side investments for some customers will have to be recouped either in the supply prices to the franchise market or in the charges for use of the distribution and transmission systems.

Despite these differences, the broad principle that there should be no distortion in the choice between demand-side and supply-side investments remains valid. The various options considered in the next chapter follow the spirit of this principle, in the context of the industry in Britain.

Incentives in the Distribution and Transmission Businesses

Several commentators have expressed concern about whether there is an incentive arising from the distribution price control (that limits charges levied for use of the electricity company's local system of wires) which encourages the companies to attempt to sell more electricity than would be efficient. The present price control restricts the average revenue which can be obtained for a unit of electricity distributed. If the incremental cost of distributing additional electricity is less than the allowed average revenue, then companies would have an undue incentive to persuade their customers to increase their electricity use. Some commentators therefore suggest that a price control which did not allow extra revenue for each additional unit sold, but instead gave the companies a lump sum each year to reward them for running their systems, would not have this effect.

If a company simply passed on to its customers a price which exceeded incremental cost, this would not constitute an inducement to excessive use of electricity - indeed, the distortion would be in the opposite direction. However, it is not clear whether or not the allowed price is significantly above incremental cost.

Companies will not normally be able to distribute extra units of electricity without incurring extra costs. The greater the number of extra units distributed, and the longer the period of time considered, the greater these costs are likely to be. Although distribution systems are planned to security standards so that there is usually extra capacity which can be used to carry more units, the companies are under an obligation to maintain security standards. Consequently, an increase in sales will tend to cause an increase in costs in order to restore the 'safety margin' set by the security standards. Because investment in the distribution system is often 'lumpy' (ie. increases in capacity tend to be large), there will be many occasions on which a small increase in sales will not require any additional cost, but, in other cases, prospective sales of additional units may lead to very large additional costs.

To avoid distortions and the inefficient use of electricity, the price control should allow companies to collect extra revenue from extra sales to the extent that they incur extra costs from those sales. The extent to which costs rise with output is an empirical question. There appears to be little published evidence that electricity systems are subject to economies of scale in the long run. In other words, it does not seem to be the case that distributing units on a system with a high load is much cheaper than doing so on a similar system scaled down to meet a smaller load. This would mean that handling extra units would be no cheaper than handling the existing average unit. In this case, a price control reflecting average distribution costs would not be inappropriate. This issue is considered further in the next chapter and will need to be fully addressed in the forthcoming price control formulae reviews.

Printe

OPTIONS FOR DISCUSSION

In this chapter some possible options for future changes to the regulatory regime are set out for discussion. To be in keeping with the regulatory regime as a whole any changes would need to:

- give the companies real incentives to promote the efficient use of electricity;
- be compatible with competition in electricity generation and supply and an efficient and profitable industry;
- protect the interests of customers and avoid undue discrimination between customers; and
- not cause any undue distortions in competition in the energy efficiency industry.

Many of the options relate to differing approaches to the price control formulae. The current formulae are due to be reviewed over the next three years. The options discussed here could, if appropriate, be included in any changes made at the time of those reviews, where other factors will also need to be considered.

Setting "X" in the Price Controls

When the distribution and transmission price controls come to be revised, if the present broad structure of the controls is retained, one factor that will need to be taken into account in setting X is the level of investment likely to be required in the relevant business. In presenting investment plans the companies could be required to demonstrate to the Director General that demand side options had been considered on an equal footing with additional capacity. The level of X would then be set to give the company an incentive to adopt the least cost option.

A possible disadvantage with this approach is that the extent of expenditure on the promotion of the efficient use of electricity would not necessarily be transparent. This could perhaps be remedied by requiring the costs and benefits of specific energy efficiency projects to be identified, together with a commitment to adopting them, before taking them into account as part of the overall consideration of the appropriate level of X. Of course, energy efficiency and the effect on investment would be only one of the various issues that would need to go towards the overall calculation of X.

Adjusting Volume Incentives in the Distribution Business

The incentive effects of the present distribution price formula were discussed in the previous chapter, and one possible alternative formulation was identified. It is not clear whether present allowed charges are significantly in excess of the incremental costs of distribution, but this is an issue that needs to be carefully examined at the time of the price review.

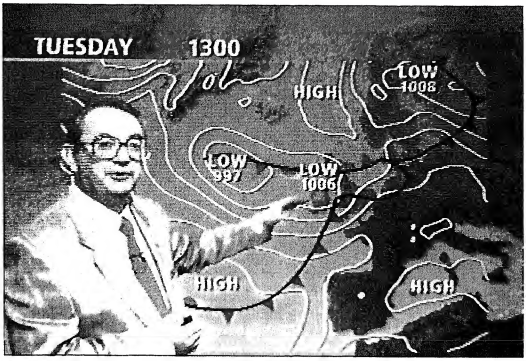
Alternative formulations of the price control will also merit consideration. It will be necessary to ensure that no new distortions are introduced, or at least that the advantages and disadvantages of any alternative approach are, on balance, preferable to those of the present approach.

One way of giving effect to the proposal to allow a lump sum revenue each year instead of a maximum per unit charge would be to allow a per unit charge based on the expected volume of sales. It would be necessary to correct for a higher or lower volume of sales the next year. A difficulty with this approach is that a severe winter with high electricity sales could mean that companies took in more money than they would be allowed under the price control. They would then have to give this back the following year in the form of lower prices. Hard winters would thus be followed by a year of lower prices and, perhaps less acceptably, mild winters by a year of higher prices.

An alternative approach would be to allow each year a fixed 'demand charge' per customer, with no allowance for unit charges. This would probably mean higher standing charges. The impact of this on households with low incomes and low electricity use would need careful consideration.

Pass-through of Energy Efficiency Costs

Under the new Gas tariff price formula, British Gas can apply to the Director General of Gas Supply to have the cost of specific energy efficiency projects passed through to customers by means of an "E" factor in the formula. OFGAS has made clear that the costs of any project cannot be passed through if they simply put up prices for customers in general - that is, the proposals cannot be designed to encourage cross-subsidisation. It has also stressed that the proposals should be properly targeted and monitored, so that their cost-effectiveness can be clearly shown.



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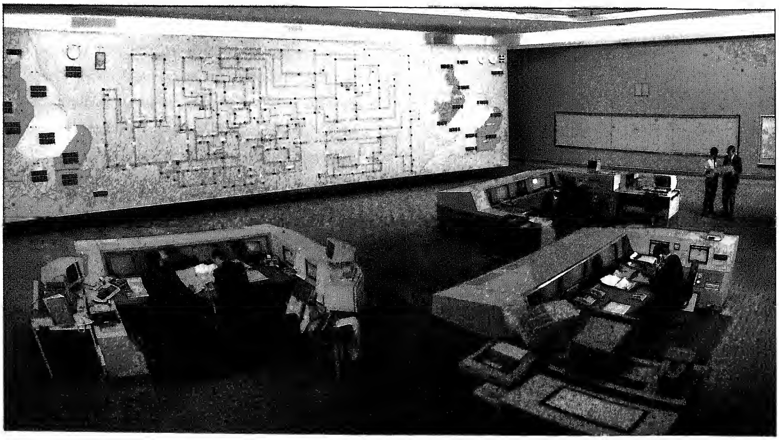
A similar approach might be considered for electricity. An "E" factor could allow the specific pass-through of the costs of approved projects suggested by the PESs. It would of course be necessary to ensure that there was no undue discrimination in the provision of the projects. A disadvantage of such an "E" factor is that it requires the direct intervention and approval of the Director General on a project by project basis. If, instead, the pass-through were automatic, the definition of "Y" would need to encompass the costs of efficiency measures of a particular description. However, it is not clear whether this could be achieved in a way which protected customers as a whole by providing incentives to efficient management. It would in any case be necessary to check that the project costs passed-through in this way complied with the description of allowable costs. This problem might be overcome in part if the costs were those associated with investments in reducing demand under agreed contracts with customers.

Standards of Performance

The Director General has the power to set standards of performance in relation to the promotion by PESs of the efficient use of electricity by customers. Such standards might refer to the provision of information on electricity consumption by appliances and the provision of specific information on the best way to use electricity. Other options could include special packages designed to provide assistance to customers to encourage them to adopt energy efficiency measures. This could be particularly valuable in the case of low income households and small businesses where access to investment funds is extremely limited. Packages could be developed to enable such customers to purchase efficiency measures on beneficial credit terms arranged by the company. The Director General could use his powers under Condition 22 of the PES licence to direct the PESs to send to their customers relevant information published by the Director General. Consideration would need to be given to the precise definition of such standards to ensure that they could be monitored and enforced.

Demand Bidding

As noted earlier, an increasing number of customers, both large and small, have demonstrated a willingness to reduce demand at times of high prices. At present they have the incentive of the resulting cost savings, and their estimated response is taken into account in forecasting demand, scheduling plant and setting prices. However, there is no formal way in which these intentions can be registered and relied upon. It would in principle be possible to introduce a system of demand bidding in the Pool whereby any member could bid into the Pool guaranteed demand savings to compete against bids by generators. This might involve load shedding



under contracts with energy management companies. It would be particularly relevant for short periods of peak demand, but with modern metering systems linked to energy management systems such a process could be extended to enable demand bids to be made throughout the day. That is, it could also be used as part of the real-time control, to reduce spinning reserve. In addition, it would also tend to reduce the market power of dominant producers.

One difficulty of such a scheme might be the ability to agree what demand would have been in the absence of the demand bid. There would also be a danger that payments to particular demand bidders would, in effect, double count the benefits of restricting demand, thereby distorting both output and generation decisions leading to a higher overall cost.

It may be that these difficulties could be overcome, and other benefits achieved, if the demand side as a whole was bid into the Pool, along with the supply side. This would be a more fundamental revision of the Pool, and its pros and cons would need careful consideration, not least by Pool members themselves.

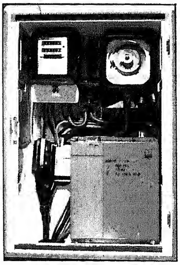
Demand Management and Second-Tier Suppliers

As the franchise declines, more customers will have a choice of supplier and new suppliers will be able to compete in the provision of energy efficiency packages. By 1998 there should be no regulatory constraints on customers grouping together to seek supply contracts from a second tier supplier. This will offer new opportunities for promoting the efficient use of electricity. For example, a second-tier supplier might have a contract with a housing or industrial estate to supply both electricity and agreed energy efficiency improvements (any net cost to the supplier being recovered through the contract price). Similar schemes could apply to blocks of flats, office blocks, shopping centres and so on. It is for consideration whether specific exemptions from the franchise, or even its earlier phasing out, would be appropriate in order to facilitate such schemes.

East Kilbride Olympia shopping centre

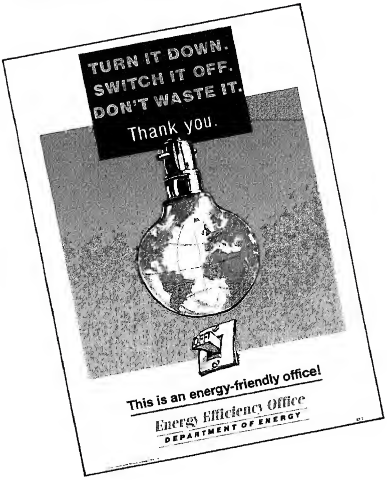
New Metering and Communications Technologies

There have been significant improvements in the technology and costs of metering and communications. These offer opportunities for new pricing and load management arrangements, and for the feedback of information on the state of the system, which could have important implications for energy efficiency. OFFER will shortly be publishing a separate paper on this topic which will provide further scope for discussion.



CONCLUSIONS

The privatisation of the electricity supply industry has already had a significant and beneficial effect on energy efficiency. The introduction of market disciplines and the profit motive into the electricity industry has of itself promoted a reconsideration of the role of the electricity companies in energy efficiency. Competition in generation and supply both show signs of bringing real benefits. Competition in generation is encouraging further improvements in the way in which fuel is used in power stations. In electricity supply competition has already given a new impetus to energy management. The promotion of greater competition in both sectors can be expected further to promote efficiency within the industry and the efficient use of electricity by its customers.


TURN IT DOWN.
SWITCH IT OFF.
DON'T WASTE IT.
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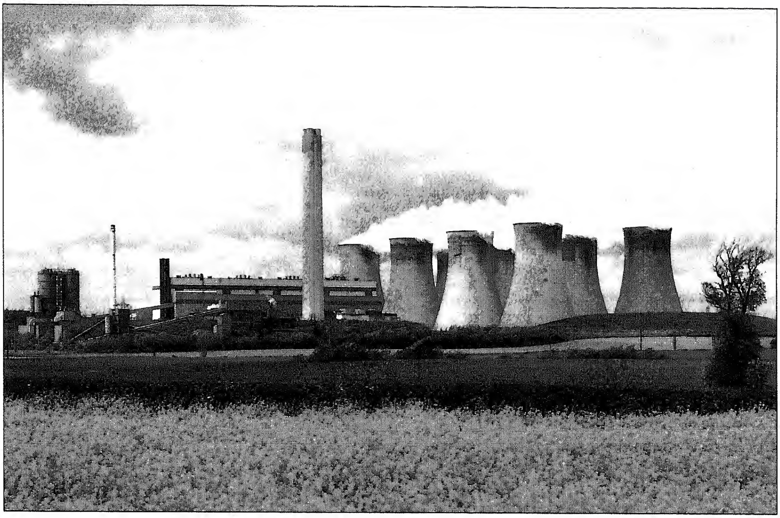
DEPARTMENT OF ENERGY

New tariff structures are helping to increase the effectiveness of price signals in the market and are encouraging load management. New metering technologies and two way communications with customers will provide new options for tariffs and demand management contracts. Under the new Codes of Practice the PESs must provide information on the efficient use of electricity for all their customers.

There continues however to be scope for further improvements. This paper has highlighted a number of areas where there may be a need to reconsider the effects of the existing incentives on the companies. A number of possibilities for change have been discussed.

Before introducing any changes OFFER will be consulting widely. This paper is being circulated to the Electricity Consumers' Committees, other consumer groups, energy efficiency specialists, the electricity and energy efficiency industries, and all others with an interest in these issues. Comments on the paper are invited. In particular comments are sought on the need for changes in the existing incentives on the companies and the appropriateness of the various options discussed in the previous section.

For the most part the discussion in this paper has drawn on the detailed arrangements found within the electricity industry in England and Wales. Whilst there is a general overlap between the arrangements and the regulatory system in England and Wales and in Scotland, there are features both of the Scottish industry and the form of its regulation which are particular to that



country. The further consideration of these issues and any proposals for change will take account of the circumstances of the industry in Scotland.

The Regional Electricity Companies, the two Scottish Companies and the National Grid Company (as holders of PES and Transmission licences) are asked to put forward illustrative projects which might be appropriate for inclusion in any "E" factor or suggestions for other appropriate ways in which their incentives to assist customers to use electricity more efficiently could be strengthened.

It would be helpful to receive comments by the end of June 1992. Although final resolution of some of the issues discussed in this consultation paper will need to be deferred until the price control reviews themselves, a further statement on these issues will be made after considering the responses to this paper.

Comments should be sent to -

The Energy Efficiency Unit
Office of Electricity Regulation
Hagley House (16th Floor)
83-85 Hagley Road
Edgbaston
BIRMINGHAM
B16 8QG

Among the publications issued by OFFER during 1991 were the following:

DETERMINATIONS

Connection agreement determinations.

Determination of Eastern Electricity and Allied Lyons connection agreement.
4/3/91. DET/R/115. £1.60.

Determination of Southern Electric and the Rover Group connection agreement.
19/4/91. DET/R/126. £1.30.

Determination of Midlands Electricity and the Rover Group connection agreement.
19/4/91. DET/R/127. £1.40.

Determination of East Midlands Electricity and the Rover Group connection agreement.
19/4/91. DET/R/128. £1.30.

Determination of Seeboard and Lombard North Central connection agreement.
31/10/91. DET/R/211. £2.90.

Standby terms determinations.

Determination of standby terms between Scottish Power Plc and Scottish Nuclear Ltd.
25/9/91. DET/R/205. £1.30.

Use of systems agreement determinations.

Determination of a use of system agreement between Yorkshire Electricity and Scottish Hydro-Electric.
2/10/91. DET/R/206. £2.00.

Determinations of whether premises fall within the PES franchise.

(Consumer, PES, 2TS)

Tilcon Ltd, Northern Electric, PowerGen.
28/1/91. DET/R/100.

Steetley Brick and Concrete Products, Northern Electric, PowerGen.
1/2/91. DET/R/104. £1.00.

J. Sainsbury (Wakefield House), London Electricity, PowerGen.
1/2/91. DET/R/105. £1.00.

TSB Bank, London Electricity, National Power.
1/2/91. DET/R/106. £1.00.

Thorn EMI CD, Southern Electric, National Power.
13/2/91. DET/R/112. £1.00.

Thorn EMI Electronics, Southern Electric, National Power.
13/2/91. DET/R/113. £1.00.

Goonvean and Rostowrack China Clay company Ltd, South Western Electricity, PowerGen.
28/2/91. DET/R/114. £1.10.

Allied Lyons, East Midlands Electricity, National Power.
4/3/91. DET/R/116. £1.00/

Tarmac Roadstone Ltd, Northern Electric, PowerGen.
25/3/91. DET/R/117. £1.00.

J. Sainsbury (Stamford House), London Electricity, PowerGen.
28/3/91. DET/R/119/ £1.00.

National Westminster Bank, London Electricity, National Power.
10/4/91/ DET/R/120. £1.00.

Tyne and Wear Passenger Transport Executive, Northern Electric, National Power.
10/4/91. DET/R/121. £1.00.

BBC, London Electricity, PowerGen.
10/4/91. DET/R/122. £1.00.

Mecca Leisure Holidays Ltd, South Western Electricity, PowerGen.
9/7/91. DET/R/183. £1.00.

Rockware Plastics Ltd, Eastern Electricity, National Power.
21/8/91. DET/R/198. £1.00.

Marks and Spencers, London Electricity, National Power.
30/10/91. DET/R/208. £1.20.

Allied Lyons Ltd, Southern Electric, National Power.
30/10/91. DET/R/209. £1.00.

South East Thames Regional Health Authority on behalf of Maidstone Health Authority, Seeboard, National Power.
30/10/91. DET/R/210. £1.20.

Chesterton on behalf of MetroCentre, Northern Electric, PowerGen.
25/11/91. DET/R/212. £1.00.

Section 23 Determinations.

A dispute concerning the provision of a security deposit or a direct debit arrangement by a commercial customer.
August 1991. S23/C/002(B).
£1.30.

A dispute concerning the provision of a security deposit or a direct debit arrangement by a commercial customer.
August 1991. S23/C/003 (B).
£1.10.

OTHER OFFER PUBLICATIONS

General

Annual report 1990: a summary of the main points.
May 1991.

Connection charges: a discussion paper.
August 1991.

Consumer matters: an audio cassette for the visually handicapped on the role of Offer. April 1991.

Electricity: a new generation.
November 1991. VHS video.
16 mins 33 secs.

Electricity Consumers' Committees: a brief guide.
November 1991.

Maximum resale price of electricity: a guide for domestic tenants and their landlords.
May 1991.

A new world of electricity: how the Office of Electricity Regulation works. November 1991. VHS video.
17 mins 58 secs.

Protecting electricity consumers in Scotland.
October 1991.

Regulatory accounts: guidance to auditors.
July 1991.

What is Offer? October 1991.

Statements by the DGES

Maximum resale price for electricity. 28th March 1991

Regulation of the British Electricity Industry: a speech given at the Society of Investment Analysts.
3rd October 1991.

Statement on direct sales limits. 21st January 1991.

AVAILABLE FROM HMSO:

Offer Annual Report 1990: Report of the Director General of Electricity Supply for the year ending 31st December 1990 to the Secretary of State for Energy and the Secretary of State for Scotland.
HCP 355 1990/91.
0102355916. £10.50.